

<110> Betenbaugh et al.

<120> Engineering Intracellular Sialylation Pathways

<130> PF509P2

<140> Unassigned

<141> Herewith

<150> 60/227,579

<151> 2000-08-25

<150> 09/516,793

<151> 2000-03-01

<150> 60/169,624

<151> 1999-12-08

<150> 60/122,582

<151> 1999-03-02

<160> 8

<170> PatentIn Ver. 2.1

<210> 1

<211> 1429

<212> DNA

<213> Homo sapiens

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<222> (1)..(693)

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acg cca atg act gag aat gga gaa atc aac ttt tca gta att ggt cag	96
Thr Pro Met Thr Glu Asn Gly Glu Ile Asn Phe Ser Val Ile Gly Gln	
20 25 30	

tat gtg gat tat ctt gtg aaa gaa cag gga gtg aag aac att ttt gtg	144
Tyr Val Asp Tyr Leu Val Lys Glu Gln Gly Val Lys Asn Ile Phe Val	
35 40 45	

aat ggc aca aca gga gaa ggc ctg tcc ctg agc gtc tca gag cgt cgc	192
Asn Gly Thr Thr Gly Glu Gly Leu Ser Leu Ser Val Ser Glu Arg Arg	
50 55 60	

cag gtt gca gag gag tgg gtg aca aaa ggg aag gac aag ctg gat cag	240
Gln Val Ala Glu Glu Trp Val Thr Lys Gly Lys Asp Lys Leu Asp Gln	
65 70 75 80	

gtg ata att cac gta gga gca ctg agc ttg aag gag tca cag gaa ctg	288
Val Ile Ile His Val Gly Ala Leu Ser Leu Lys Glu Ser Gln Glu Leu	

546

1429

85	90	95	
gcc caa cat gca gca gaa ata gga gct gat ggc atc gct gtc att gca			336
Ala Gln His Ala Ala Glu Ile Gly Ala Asp Gly Ile Ala Val Ile Ala			
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ccg ttc ttc ctc aag cca tgg acc aaa gat atc ctg att aat ttc cta			384
Pro Phe Phe Leu Lys Pro Trp Thr Lys Asp Ile Leu Ile Asn Phe Leu			
115	120	125	
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Lys Glu Val Ala Ala Ala Ala Pro Ala Leu Pro Phe Tyr Tyr Tyr His			
130	135	140	
att cct gcc ttg aca ggg gta aag att cgt gct gag gag ttg ttg gat			480
Ile Pro Ala Leu Thr Gly Val Lys Ile Arg Ala Glu Glu Leu Leu Asp			
145	150	155	160
ggg att ctg gat aag atc ccc acc ttc caa ggg ctg aaa ttc agt gat			528
Gly Ile Leu Asp Lys Ile Pro Thr Phe Gln Gly Leu Lys Phe Ser Asp			
165	170	175	
aca gat ctc tta gac ttc ggg caa tgt gtt gat cag aat cgc cag caa			576
Thr Asp Leu Leu Asp Phe Gly Gln Cys Val Asp Gln Asn Arg Gln Gln			
180	185	190	
cag ttt gct ttc ctt ttt ggg gtg gat gag caa ctg ttg agt gct ctg			624
Gln Phe Ala Phe Leu Phe Gly Val Asp Glu Gln Leu Leu Ser Ala Leu			
195	200	205	
gtg atg gga gca act gga gca gtg ggc agt ttt gta tcc aga gat tta			672
Val Met Gly Ala Thr Gly Ala Val Gly Ser Phe Val Ser Arg Asp Leu			
210	215	220	
tca act ttg ttg tca aac tag gttttggagt gtcacagacc aaagccatca			723
Ser Thr Leu Leu Ser Asn			
225	230		
tgactctggt ctctgggatt ccaatgggcc caccocggct tccactgcag aaagcctcca			783
gggagtttac tgatagtgct gaagctaaac tgaagagcct ggatttcctt tctttcactg			843
atttaaagga tggaaacttg gaagctggta gctagtgcct ctctatcaaa tcagggtttg			903
caccttgaga cataatctac cttaaatagt gcattttttt ctcaggggaat ttagatgaa			963
cttgaataaa ctctcctagc aaatgaaatc tcacaataag cattgaggta ctttttgtga			1023
gccttaaaaa gtcttatttt gtgaaggggc aaaaactcta ggagtcacaa ctctcagtca			1083
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aggaaaattg taattgatta attccatctg tctttaggag ctctcattat ctcggtctct			1203
ggttcctaata cctatttttaa agttgtctaa ttttaaacca ctataatatg tcttcatttt			1263
aataaatatt catttggaat ctaggaaaac tctgagctac tgcatttagg caggcacttt			1323

aataccaaac tgtaacatgt ctcaactgta tacaactcaa aatacaccag ctcatttggc 1383
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 Tyr Val Asp Tyr Leu Val Lys Glu Gln Gly Val Lys Asn Ile Phe Val
 35 40 45
 Asn Gly Thr Thr Gly Glu Gly Leu Ser Leu Ser Val Ser Glu Arg Arg
 50 55 60
 Gln Val Ala Glu Glu Trp Val Thr Lys Gly Lys Asp Lys Leu Asp Gln
 65 70 75 80
 Val Ile Ile His Val Gly Ala Leu Ser Leu Lys Glu Ser Gln Glu Leu
 85 90 95
 Ala Gln His Ala Ala Glu Ile Gly Ala Asp Gly Ile Ala Val Ile Ala
 100 105 110
 Pro Phe Phe Leu Lys Pro Trp Thr Lys Asp Ile Leu Ile Asn Phe Leu
 115 120 125
 Lys Glu Val Ala Ala Ala Ala Pro Ala Leu Pro Phe Tyr Tyr Tyr His
 130 135 140
 Ile Pro Ala Leu Thr Gly Val Lys Ile Arg Ala Glu Glu Leu Leu Asp
 145 150 155 160
 Gly Ile Leu Asp Lys Ile Pro Thr Phe Gln Gly Leu Lys Phe Ser Asp
 165 170 175
 Thr Asp Leu Leu Asp Phe Gly Gln Cys Val Asp Gln Asn Arg Gln Gln
 180 185 190
 Gln Phe Ala Phe Leu Phe Gly Val Asp Glu Gln Leu Leu Ser Ala Leu
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 1 5 10 15

ggg cga ccg tcc cgg ggc cgg ccg ccg aag ctg cag cgc aac tct cgc 96
 Gly Arg Pro Ser Arg Gly Arg Pro Pro Lys Leu Gln Arg Asn Ser Arg
 20 25 30

ggc ggc cag ggc cga ggt gtg gag aag ccc ccg cac ctg gca gcc cta 144
 Gly Gly Gln Gly Arg Gly Val Glu Lys Pro Pro His Leu Ala Ala Leu
 35 40 45

att ctg gcc cgg gga ggc agc aaa ggc atc ccc ctg aag aac att aag 192
 Ile Leu Ala Arg Gly Gly Ser Lys Gly Ile Pro Leu Lys Asn Ile Lys
 50 55 60

cac ctg gcg ggg gtc ccg ctc att ggc tgg gtc ctg cgt gcg gcc ctg 240
 His Leu Ala Gly Val Pro Leu Ile Gly Trp Val Leu Arg Ala Ala Leu
 65 70 75 80

gat tca ggg gcc ttc cag agt gta tgg gtt tcc aca gac cat gat gaa 288
 Asp Ser Gly Ala Phe Gln Ser Val Trp Val Ser Thr Asp His Asp Glu
 85 90 95

att gag aat gtg gcc aaa caa ttt ggt gca caa gtt cat cga aga agt 336
 Ile Glu Asn Val Ala Lys Gln Phe Gly Ala Gln Val His Arg Arg Ser
 100 105 110

tct gaa gtt tca aaa gac agc tct acc tca cta gat gcc atc ata gaa 384
 Ser Glu Val Ser Lys Asp Ser Ser Thr Ser Leu Asp Ala Ile Ile Glu
 115 120 125

ttt ctt aat tat yat aat gag gkt gac att gta gga aat att caa gct 432
 Phe Leu Asn Tyr Xaa Asn Glu Xaa Asp Ile Val Gly Asn Ile Gln Ala
 130 135 140

act tct yca tgt tta cat cct act gat ctt caa aaa gtt gca gaa atg 480
 Thr Ser Xaa Cys Leu His Pro Thr Asp Leu Gln Lys Val Ala Glu Met
 145 150 155 160

att cga gaa gaa gga tat gat tct gkt ttc tct gtt gtg aga cgc cat 528
 Ile Arg Glu Glu Gly Tyr Asp Ser Xaa Phe Ser Val Val Arg Arg His

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cag ttt cga tgg agt gaa att cag aaa gga gtt cgt gaa gtg acc gaa Gln Phe Arg Trp Ser Glu Ile Gln Lys Gly Val Arg Glu Val Thr Glu 180 185 190			576
cct ctg aat tta aat cca gct aaa cgg cct cgt cga caa gac tgg gat Pro Leu Asn Leu Asn Pro Ala Lys Arg Pro Arg Arg Gln Asp Trp Asp 195 200 205			624
gga gaa tta tat gaa aat ggc tca ttt tat ttt gct aaa aga cat ttg Gly Glu Leu Tyr Glu Asn Gly Ser Phe Tyr Phe Ala Lys Arg His Leu 210 215 220			672
ata gag atg ggt tac ttg cag ggt gga aaa tgg cat act acg aaa tgc Ile Glu Met Gly Tyr Leu Gln Gly Gly Lys Trp His Thr Thr Lys Cys 225 230 235 240			720
gag ctg gaa cat agt gtg gat ata gat gtg gat att gat tgg cct att Glu Leu Glu His Ser Val Asp Ile Asp Val Asp Ile Asp Trp Pro Ile 245 250 255			768
gca gag caa aga gta tta aga tat ggc tat ttt ggc aaa gag aag ctt Ala Glu Gln Arg Val Leu Arg Tyr Gly Tyr Phe Gly Lys Glu Lys Leu 260 265 270			816
aag gaa ata aaa ctt ttg gtt tgc aat att gat gga tgt ctc acc aat Lys Glu Ile Lys Leu Leu Val Cys Asn Ile Asp Gly Cys Leu Thr Asn 275 280 285			864
ggc cac att tat gta tca gga gac caa aaa gaa ata ata tct tat gat Gly His Ile Tyr Val Ser Gly Asp Gln Lys Glu Ile Ile Ser Tyr Asp 290 295 300			912
gta aaa gat gct att ggg ata agt tta tta aag aaa agt ggt att gag Val Lys Asp Ala Ile Gly Ile Ser Leu Leu Lys Lys Ser Gly Ile Glu 305 310 315 320			960
gtg agg cta atc tca gaa agg gcc tgt tca aag cag acg ctg tct tct Val Arg Leu Ile Ser Glu Arg Ala Cys Ser Lys Gln Thr Leu Ser Ser 325 330 335			1008
tta aaa ctg gat tgc aaa atg gaa gtc agt gta tca gac aag cta gca Leu Lys Leu Asp Cys Lys Met Glu Val Ser Val Ser Asp Lys Leu Ala 340 345 350			1056
gtt gta gat gaa tgg aga aaa gaa atg ggc ctg tgc tgg aaa gaa gtg Val Val Asp Glu Trp Arg Lys Glu Met Gly Leu Cys Trp Lys Glu Val 355 360 365			1104
gca tat ctt gga aat gaa gtg tct gat gaa gag tgc ttg aag aga gtg Ala Tyr Leu Gly Asn Glu Val Ser Asp Glu Glu Cys Leu Lys Arg Val 370 375 380			1152
ggc cta agt ggc gct cct gct gat gcc tgt tcc tac gcc cag aag gct Gly Leu Ser Gly Ala Pro Ala Asp Ala Cys Ser Tyr Ala Gln Lys Ala 385 390 395 400			1200

165 170 175

gtt gga tac att tgc aaa tgt aat ggt ggc cgt ggt gcc atc cga gaa 1248
 Val Gly Tyr Ile Cys Lys Cys Asn Gly Gly Arg Gly Ala Ile Arg Glu
 405 410 415

ttt gca gag cac att tgc cta cta atg gaa aaa gtt aat aat tca tgc 1296
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caa aaa tag 1305
 Gln Lys

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 Gly Gly Gln Gly Arg Gly Val Glu Lys Pro Pro His Leu Ala Ala Leu
 35 40 45
 Ile Leu Ala Arg Gly Gly Ser Lys Gly Ile Pro Leu Lys Asn Ile Lys
 50 55 60
 His Leu Ala Gly Val Pro Leu Ile Gly Trp Val Leu Arg Ala Ala Leu
 65 70 75 80
 Asp Ser Gly Ala Phe Gln Ser Val Trp Val Ser Thr Asp His Asp Glu
 85 90 95
 Ile Glu Asn Val Ala Lys Gln Phe Gly Ala Gln Val His Arg Arg Ser
 100 105 110
 Ser Glu Val Ser Lys Asp Ser Ser Thr Ser Leu Asp Ala Ile Ile Glu
 115 120 125
 Phe Leu Asn Tyr Xaa Asn Glu Xaa Asp Ile Val Gly Asn Ile Gln Ala
 130 135 140
 Thr Ser Xaa Cys Leu His Pro Thr Asp Leu Gln Lys Val Ala Glu Met
 145 150 155 160

Ile Arg Glu Glu Gly Tyr Asp Ser Xaa Phe Ser Val Val Arg Arg His
 165 170 175
 Gln Phe Arg Trp Ser Glu Ile Gln Lys Gly Val Arg Glu Val Thr Glu
 180 185 190
 Pro Leu Asn Leu Asn Pro Ala Lys Arg Pro Arg Arg Gln Asp Trp Asp
 195 200 205
 Gly Glu Leu Tyr Glu Asn Gly Ser Phe Tyr Phe Ala Lys Arg His Leu
 210 215 220
 Ile Glu Met Gly Tyr Leu Gln Gly Gly Lys Trp His Thr Thr Lys Cys
 225 230 235 240
 Glu Leu Glu His Ser Val Asp Ile Asp Val Asp Ile Asp Trp Pro Ile
 245 250 255
 Ala Glu Gln Arg Val Leu Arg Tyr Gly Tyr Phe Gly Lys Glu Lys Leu
 260 265 270
 Lys Glu Ile Lys Leu Leu Val Cys Asn Ile Asp Gly Cys Leu Thr Asn
 275 280 285
 Gly His Ile Tyr Val Ser Gly Asp Gln Lys Glu Ile Ile Ser Tyr Asp
 290 295 300
 Val Lys Asp Ala Ile Gly Ile Ser Leu Leu Lys Lys Ser Gly Ile Glu
 305 310 315 320
 Val Arg Leu Ile Ser Glu Arg Ala Cys Ser Lys Gln Thr Leu Ser Ser
 325 330 335
 Leu Lys Leu Asp Cys Lys Met Glu Val Ser Val Ser Asp Lys Leu Ala
 340 345 350
 Val Val Asp Glu Trp Arg Lys Glu Met Gly Leu Cys Trp Lys Glu Val
 355 360 365
 Ala Tyr Leu Gly Asn Glu Val Ser Asp Glu Glu Cys Leu Lys Arg Val
 370 375 380
 Gly Leu Ser Gly Ala Pro Ala Asp Ala Cys Ser Tyr Ala Gln Lys Ala
 385 390 395 400
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 405 410 415
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 Gln Lys

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 cac ccg tgc ttc atc att gcc gag atc ggc cag aac cac cag ggc gac 96
 His Pro Cys Phe Ile Ile Ala Glu Ile Gly Gln Asn His Gln Gly Asp
 20 25 30
 ctg gac gta gcc aag cgc atg atc cgc atg gcc aag gag tgt ggg gct 144
 Leu Asp Val Ala Lys Arg Met Ile Arg Met Ala Lys Glu Cys Gly Ala

35						40				45						
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Asp	Cys	Ala	Lys	Phe	Gln	Lys	Ser	Glu	Leu	Glu	Phe	Lys	Phe	Asn	Arg	
50						55				60						
aaa	gcc	ttg	gag	agg	cca	tac	acc	tcg	aag	cat	tcc	tgg	ggg	aag	acg	240
Lys	Ala	Leu	Glu	Arg	Pro	Tyr	Thr	Ser	Lys	His	Ser	Trp	Gly	Lys	Thr	
65				70						75				80		
tac	ggg	gag	cac	aaa	cga	cat	ctg	gag	ttc	agc	cat	gac	cag	tac	agg	288
Tyr	Gly	Glu	His	Lys	Arg	His	Leu	Glu	Phe	Ser	His	Asp	Gln	Tyr	Arg	
				85				90						95		
gag	ctg	cag	agg	tac	gcc	gag	gag	gtt	ggg	atc	ttc	ttc	act	gcc	tct	336
Glu	Leu	Gln	Arg	Tyr	Ala	Glu	Glu	Val	Gly	Ile	Phe	Phe	Thr	Ala	Ser	
		100						105				110				
ggc	atg	gat	gag	atg	gca	gtt	gaa	ttc	ctg	cat	gaa	ctg	aat	gtt	cca	384
Gly	Met	Asp	Glu	Met	Ala	Val	Glu	Phe	Leu	His	Glu	Leu	Asn	Val	Pro	
115						120				125						
ttt	ttc	aaa	gtt	gga	tct	gga	gac	act	aat	aat	ttt	cct	tat	ctg	gaa	432
Phe	Phe	Lys	Val	Gly	Ser	Gly	Asp	Thr	Asn	Asn	Phe	Pro	Tyr	Leu	Glu	
130						135				140						
aag	aca	gcc	aaa	aaa	ggc	cgc	cca	atg	gtg	atc	tcc	agt	ggg	atg	cag	480
Lys	Thr	Ala	Lys	Lys	Gly	Arg	Pro	Met	Val	Ile	Ser	Ser	Gly	Met	Gln	
145				150						155				160		
tca	atg	gac	acc	atg	aag	caa	gtt	tat	cag	atc	gtg	aag	ccc	ctc	aac	528
Ser	Met	Asp	Thr	Met	Lys	Gln	Val	Tyr	Gln	Ile	Val	Lys	Pro	Leu	Asn	
				165				170						175		
ccc	aac	ttc	tgc	ttc	ttg	cag	tgt	acc	agc	gca	tac	ccg	ctc	cag	cct	576
Pro	Asn	Phe	Cys	Phe	Leu	Gln	Cys	Thr	Ser	Ala	Tyr	Pro	Leu	Gln	Pro	
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gag	gac	gtc	aac	ctg	cgg	gtc	atc	tcg	gaa	tat	cag	aag	ctc	ttt	cct	624
Glu	Asp	Val	Asn	Leu	Arg	Val	Ile	Ser	Glu	Tyr	Gln	Lys	Leu	Phe	Pro	
195						200				205						
gac	att	ccc	ata	ggg	tat	tct	ggg	cat	gaa	aca	ggc	ata	gcg	ata	tct	672
Asp	Ile	Pro	Ile	Gly	Tyr	Ser	Gly	His	Glu	Thr	Gly	Ile	Ala	Ile	Ser	
210						215				220						
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Val	Ala	Ala	Val	Ala	Leu	Gly	Ala	Lys	Val	Leu	Glu	Arg	His	Ile	Thr	
225				230						235				240		
ttg	gac	aag	acc	tgg	aag	ggg	agt	gac	cac	tcg	gcc	tcg	ctg	gag	cct	768
Leu	Asp	Lys	Thr	Trp	Lys	Gly	Ser	Asp	His	Ser	Ala	Ser	Leu	Glu	Pro	

ctg	ggc	tcc	cca	acc	aag	cag	ctg	ctg	ccc	tgt	gag	atg	gcc	tgc	aat	864
Leu	Gly	Ser	Pro	Thr	Lys	Gln	Leu	Leu	Pro	Cys	Glu	Met	Ala	Cys	Asn	
	275						280					285				
gag	aag	ctg	ggc	aag	tct	gtg	gtg	gcc	aaa	gtg	aaa	att	ccg	gaa	ggc	912
Glu	Lys	Leu	Gly	Lys	Ser	Val	Val	Ala	Lys	Val	Lys	Ile	Pro	Glu	Gly	
	290					295					300					
acc	att	cta	aca	atg	gac	atg	ctc	acc	gtg	aag	gtg	ggg	gag	ccc	aaa	960
Thr	Ile	Leu	Thr	Met	Asp	Met	Leu	Thr	Val	Lys	Val	Gly	Glu	Pro	Lys	
305					310					315					320	
gcc	tat	cct	cct	gaa	gac	atc	ttt	aat	cta	gtg	ggc	aag	aag	gtc	ctg	1008
Ala	Tyr	Pro	Pro	Glu	Asp	Ile	Phe	Asn	Leu	Val	Gly	Lys	Lys	Val	Leu	
				325					330					335		
gtc	act	gtt	gaa	gag	gat	gac	acc	atc	atg	gaa	gaa	ttg	gta	gat	aat	1056
Val	Thr	Val	Glu	Glu	Asp	Asp	Thr	Ile	Met	Glu	Glu	Leu	Val	Asp	Asn	
			340					345					350			
cat	ggc	aaa	aaa	atc	aag	tct	taa									1080
His	Gly	Lys	Lys	Ile	Lys	Ser										
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			20					25					30			
Leu	Asp	Val	Ala	Lys	Arg	Met	Ile	Arg	Met	Ala	Lys	Glu	Cys	Gly	Ala	
		35					40					45				
Asp	Cys	Ala	Lys	Phe	Gln	Lys	Ser	Glu	Leu	Glu	Phe	Lys	Phe	Asn	Arg	
	50					55					60					
Lys	Ala	Leu	Glu	Arg	Pro	Tyr	Thr	Ser	Lys	His	Ser	Trp	Gly	Lys	Thr	
65				70						75					80	
Tyr	Gly	Glu	His	Lys	Arg	His	Leu	Glu	Phe	Ser	His	Asp	Gln	Tyr	Arg	
			85						90					95		
Glu	Leu	Gln	Arg	Tyr	Ala	Glu	Glu	Val	Gly	Ile	Phe	Phe	Thr	Ala	Ser	
			100					105					110			
Gly	Met	Asp	Glu	Met	Ala	Val	Glu	Phe	Leu	His	Glu	Leu	Asn	Val		

210		215		220
Val Ala Ala Val Ala Leu Gly Ala Lys Val Leu Glu Arg His Ile Thr				
225		230		240
Leu Asp Lys Thr Trp Lys Gly Ser Asp His Ser Ala Ser Leu Glu Pro				
	245		250	255
Gly Glu Leu Ala Glu Leu Val Arg Ser Val Arg Leu Val Glu Arg Ala				
	260		265	270
Leu Gly Ser Pro Thr Lys Gln Leu Leu Pro Cys Glu Met Ala Cys Asn				
	275		280	285
Glu Lys Leu Gly Lys Ser Val Val Ala Lys Val Lys Ile Pro Glu Gly				
	290		295	300
Thr Ile Leu Thr Met Asp Met Leu Thr Val Lys Val Gly Glu Pro Lys				
305		310		320
Ala Tyr Pro Pro Glu Asp Ile Phe Asn Leu Val Gly Lys Lys Val Leu				
	325		330	335
Val Thr Val Glu Glu Asp Asp Thr Ile Met Glu Glu Leu Val Asp Asn				
	340		345	350
His Gly Lys Lys Ile Lys Ser				
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agt gtt gat att gca aga gaa atg ata tta aaa gcc aaa gag gcc ggt	96
Ser Val Asp Ile Ala Arg Glu Met Ile Leu Lys Ala Lys Glu Ala Gly	
20 25 30	
gtt aat gca gta aaa ttc caa aca ttt aaa gct gat aaa tta att tca	144
Val Asn Ala Val Lys Phe Gln Thr Phe Lys Ala Asp Lys Leu Ile Ser	
35 40 45	
gct att gca cct aag gca gag tat caa ata aaa aac aca gga gaa tta	192
Ala Ile Ala Pro Lys Ala Glu Tyr Gln Ile Lys Asn Thr Gly Glu Leu	
50 55 60	
gaa tct cag tta gaa atg aca aaa aag ctt gaa atg aag tat gac gat	240
Glu Ser Gln Leu Glu Met Thr Lys Lys Leu Glu Met Lys Tyr Asp Asp	
65 70 75 80	
tat ctc cat cta atg gaa tat gca gtc agt tta aat tta gat gtt ttt	288
Tyr Leu His Leu Met Glu Tyr Ala Val Ser Leu Asn Leu Asp Val Phe	
85 90 95	
tct acc cct ttt gac gaa gac tct att gat ttt tta gca tct ttg aaa	336
Ser Thr Pro Phe Asp Glu Asp Ser Ile Asp Phe Leu Ala Ser Leu Lys	

100	105	110	
caa aaa ata tgg aaa atc cct tca ggt gag tta ttg aat tta ccg tat			384
Gln Lys Ile Trp Lys Ile Pro Ser Gly Glu Leu Leu Asn Leu Pro Tyr			
115	120	125	
ctt gaa aaa ata gcc aag ctt ccg atc cct gat aag aaa ata atc ata			432
Leu Glu Lys Ile Ala Lys Leu Pro Ile Pro Asp Lys Lys Ile Ile Ile			
130	135	140	
tca aca gga atg gct act att gat gag ata aaa cag tct gtt tct att			480
Ser Thr Gly Met Ala Thr Ile Asp Glu Ile Lys Gln Ser Val Ser Ile			
145	150	155	160
ttt ata aat aat aaa gtt ccg gtt ggt aat att aca ata tta cat tgc			528
Phe Ile Asn Asn Lys Val Pro Val Gly Asn Ile Thr Ile Leu His Cys			
165	170	175	
aat act gaa tat cca acg ccc ttt gag gat gta aac ctt aat gct att			576
Asn Thr Glu Tyr Pro Thr Pro Phe Glu Asp Val Asn Leu Asn Ala Ile			
180	185	190	
aat gat ttg aaa aaa cac ttc cct aag aat aac ata ggc ttc tct gat			624
Asn Asp Leu Lys Lys His Phe Pro Lys Asn Asn Ile Gly Phe Ser Asp			
195	200	205	
cat tct agc ggg ttt tat gca gct att gcg gcg gtg cct tat gga ata			672
His Ser Ser Gly Phe Tyr Ala Ala Ile Ala Ala Val Pro Tyr Gly Ile			
210	215	220	
act ttt att gaa aaa cat ttc act tta gat aaa tct atg tct ggc cca			720
Thr Phe Ile Glu Lys His Phe Thr Leu Asp Lys Ser Met Ser Gly Pro			
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gat cat ttg gcc tca ata gaa cct gat gaa ctg aaa cat ctt tgt att			768
Asp His Leu Ala Ser Ile Glu Pro Asp Glu Leu Lys His Leu Cys Ile			
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ggg gtc agg tgt gtt gaa aaa tct tta ggt tca aat agt aaa gtg gtt			816
Gly Val Arg Cys Val Glu Lys Ser Leu Gly Ser Asn Ser Lys Val Val			
260	265	270	
aca gct tca gaa agg aag aat aaa atc gta gca aga aag tct att ata			864
Thr Ala Ser Glu Arg Lys Asn Lys Ile Val Ala Arg Lys Ser Ile Ile			
275	280	285	
gct aaa aca gag ata aaa aaa ggt gag gtt ttt tca gaa aaa aat ata			912
Ala Lys Thr Glu Ile Lys Lys Gly Glu Val Phe Ser Glu Lys Asn Ile			
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aca aca aaa aga cct ggt aat ggt atc agt ccg atg gag tgg tat aat			960
Thr Thr Lys Arg Pro Gly Asn Gly Ile Ser Pro Met Glu Trp Tyr Asn			
305	310	315	320
tta ttg ggt aaa att gca gag caa gac ttt att cca gat gaa tta ata			1008
Leu Leu Gly Lys Ile Ala Glu Gln Asp Phe Ile Pro Asp Glu Leu Ile			
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Glu	Ser	Gln	Leu	Glu	Met	Thr	Lys	Lys	Leu	Glu	Met	Lys	Tyr	Asp	Asp		
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Leu	Glu	Lys	Ile	Ala	Lys	Leu	Pro	Ile	Pro	Asp	Lys	Lys	Ile	Ile	Ile		
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Ser	Thr	Gly	Met	Ala	Thr	Ile	Asp	Glu	Ile	Lys	Gln	Ser	Val	Ser	Ile		
145					150					155					160		
Phe	Ile	Asn	Asn	Lys	Val	Pro	Val	Gly	Asn	Ile	Thr	Ile	Leu	His	Cys		
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Asn	Thr	Glu	Tyr	Pro	Thr	Pro	Phe	Glu	Asp	Val	Asn	Leu	Asn	Ala	Ile		
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His	Ser	Gly	Phe	Tyr	Ala	Ala	Ile	Ala	Ala	Val	Pro	Tyr	Gly	Ile			
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Thr	Phe	Ile	Glu	Lys	His	Phe	Thr	Leu	Asp	Lys	Ser	Met	Ser	Gly	Pro		
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Gly	Val	Arg	Cys	Val	Glu	Lys	Ser	Leu	Gly	Ser	Asn	Ser	Lys	Val	Val		
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Ala	Lys	Thr	Glu	Ile	Lys	Lys	Gly	Glu	Val	Phe	Ser	Glu	Lys	Asn	Ile		
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